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Abstract

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Keywords

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EFFECTS OF HIGH OIL CORN AND FAT LEVEL ON GROWTH PERFORMANCE OF NURSERY PIGS

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Summary

Two studies were conducted to evaluate the effects of adding high oil corn to nursery diets as compared to other sources of fat. The results of both studies suggest that addition of fat to the nursery pig diet, regardless of the source, has no significant influence on growth performance until late in the nursery phase.

(Key Words: Weanling Pigs, High Oil Corn, Fat Source.)

Introduction

Recently, a tremendous amount of improvement has occurred in the genetic potential of the pig to produce lean pork. With this improvement comes the challenge of feeding the pig a greater amount of nutrients each day so that it can perform to its genetic potential. Nutrient intake can be limited by the pig's ability to consume feed. To compensate for the performance-limiting effects of feed intake, an interest in the use of feedstuffs with higher nutrient density is increasing in the swine industry. Maintaining the proper balance between nutrients is also important. As the concentration of energy increases, the relative levels of all other nutrients must be adjusted to allow for the proper balance between energy and these nutrients.

Carbohydrates and fats in the diet supply most of the pig's caloric needs. Fats and oils contain about 2.25 times as much metabolizable energy as most of the cereal grains. The addition of fat to swine diets usually will increase the cost of the diet. An improvement in pig performance must be realized in order to offset this increase in diet cost.

High oil corn (HOC) is a type of yellow dent corn that contains more oil and, therefore, more energy than typical corn. High oil corn also contains higher concentrations of lysine and tryptophan. A new challenge for the swine industry is to determine how to best apply these characteristics to the feeding of swine.

Therefore, the objective of the following two trials was to compare the growth performance benefits of feeding nursery pigs a diet containing either no added fat, HOC, or increased levels of energy from various other sources.

Procedures

Experiment 1. One hundred and eighty five pigs were weaned at 20 ± 2 d of age, blocked by weight (initially 12.4 ± 1.0 lb), and placed on a common phase I diet from d 0 to 3 postweaning. This was a pelleted diet containing 5% spray-dried plasma protein, 2.5% select menhaden fish meal, 1.75% spray-dried blood meal, and 20% dried whey. Each treatment had six or seven pigs/pen (depending upon the block) and six pens. On d 3, the pens were allotted to one of five treatments and switched to the phase II experimental diets (Table 1). On d 13, the pigs were switched to phase III experimental diets and remained on the same dietary treatments until the conclusion of the trial on d 34. During phases II and III, the control diets consisted of yellow-dent corn (3.7% fat and .26% lysine) and soybean meal formulated to 1.35 and 1.25% lysine, respectively. In the second treatment, HOC (7.8% fat and

.31% lysine) replaced the traditional yellow-dent corn and some of the soybean meal found in the control diet to achieve an equal lysine level. The three additional treatments were obtained by adding either soybean oil, choice white grease, or poultry fat to the control diet to achieve the same level of fat as the HOC treatment.

The pigs were weighed and feed disappearance was determined on d 3, 13, 20, 27, and 34 postweaning. These data were used to calculate ADG, ADFI, and F/G.

Experiment 2. One hundred and eighty pigs were weaned at 20 ± 2 d of age, blocked by weight (initially 13.13 ± 1.0 lb), and placed on a common phase I diet from d 0 to 4 postweaning. The composition of the phase I diet was the same as in Exp. 1. Each treatment had six pigs/pen and six pens. On d 4, the pigs were allotted to one of five treatments and switched to the phase II experimental diets. On d 14, the pigs were switched to phase III experimental diets and remained on the same dietary treatments until the trial's conclusion on d 35. During phases II and III, the control diets consisted of corn and soybean meal formulated to 1.35 and 1.25% lysine, respectively. In the second treatment, HOC (7.8% fat and .31% lysine) replaced the traditional yellow-dent corn and some of the soybean meal found in the control diet to achieve a similar lysine level. The third treatment consisted of the control diet and added soy oil (2.3% in phase II and 2.6% in phase III) to equal the energy level of the second treatment. The fourth treatment consisted of the HOC treatment plus the level of soy oil found in treatment 3. Treatment 5 was formulated with normal dent corn, but soy oil (4.4% in phase II and 5.0% in phase III) was added to make this diet isocaloric to treatment 4.

The pigs were weighed and feed disappearance was determined on d 4, 14, 21, 28, and 35 postweaning. These data were used to calculate ADG, ADFI, and F/G.

In both experiments, the pigs were housed in an environmentally controlled nursery in 5 × 5 ft pens, with one self-feeder and a nipple waterer to allow ad libitum access to feed and water.

The data were analyzed as a randomized complete block design, with pen as the experimental unit. Pigs were blocked on the basis of initial weight. Analysis of variance was performed using the GLM procedure of SAS. Day 3 weight and d 4 weight were used as a covariate in the analyses of Exp. 1 and 2, respectively.

Results

Experiment 1. From d 0 to 3 postweaning (when all pigs were fed a common phase I diet), ADG, ADFI, and F/G were .62, .45, and .73, respectively.

From d 3 to 13 postweaning, no differences occurred in ADG (Table 2.). However, pigs fed the control diet had greater ($P<.05$) ADFI than pigs fed the diet containing poultry fat. Pigs fed the control diet or diets containing soy oil or poultry fat had lower ($P<.10$) F/G than pigs fed HOC.

For the entire phase III period (d 13 to 34 postweaning), no differences occurred in ADG. However, ADFI was reduced ($P<.05$) by feeding poultry fat. Also, pigs fed poultry fat had improved ($P<.05$) F/G when compared to those fed soy oil.

Overall (d 0 to 34 postweaning), neither ADG or F/G were affected by either dietary fat or source. However, ADFI was reduced ($P<.05$) when pigs were fed poultry fat compared to the other dietary treatments.

Experiment 2. From d 0 to 4 postweaning (when all pigs were fed a common phase I diet), ADG, ADFI, and F/G were .69, .56, and .81, respectively.

During the phase II period (d 4 to 14 postweaning), ADG was improved by feeding regular corn and 2.3% soy oil rather than the control ($P=.06$), HOC ($P<.01$), or HOC and 2.3% soy oil ($P<.06$) diets (Table 3.). Additionally, pigs fed regular corn and 2.3% soy oil had greater ($P<.04$) ADG than pigs fed HOC. Average daily feed intake was

greater ($P=.08$) for pigs fed regular corn and 2.3% soy oil rather than HOC and 2.3% soy oil. Feed efficiency was improved by feeding either regular corn and 2.3% soy oil ($P<.05$) or regular corn and 4.4% soy oil ($P=.08$) rather than HOC.

No differences in ADG or ADFI occurred during the phase III period (d 14 to 35). The numeric differences in ADG and ADFI caused F/G to be improved by feeding regular corn and 2.6% soy oil ($P=.10$) or HOC and 2.6% soy oil ($P<.07$) rather than the control diet. Pigs fed HOC or regular corn and 5.0% soy oil had intermediate F/G. In both studies, numerical improvements in ADG and F/G were observed during the last week of phase III for pigs fed added fat.

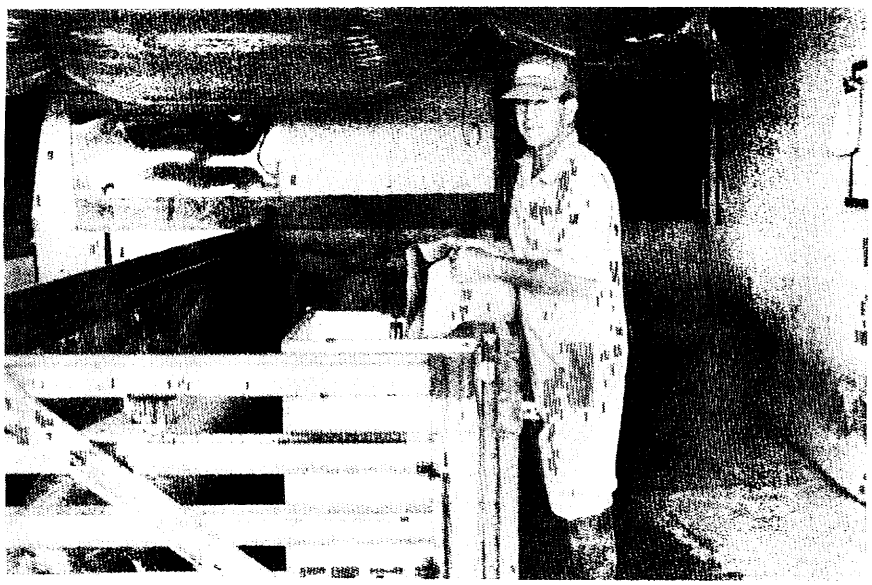
Overall (d 0 to 35 postweaning), pigs fed regular corn and 2.6% soy oil had greater ($P<.05$) ADG than pigs fed either the control or HOC diets. No differences in ADFI occurred. However, F/G was improved by feeding either regular corn and 2.6% soy oil ($P<.07$) or HOC and 2.6% soy oil ($P=.06$).

Discussion

Several previous trials have demonstrated the limited ability of the nursery pig to efficiently use dietary fat before 5 to 6 weeks of age. Possible explanations include decreased levels of fatty acid binding protein shortly after weaning, impaired digestion because of a fat-induced sloughing of intestinal villi cells, or immature metabolic enzyme systems. As in many studies, our results demonstrate little benefit obtained from feeding any of the various fat sources or levels to nursery pigs until late in the phase III period.

Previous research with older pigs has indicated that the feeding value of HOC is correlated highly with its increased nutrient density (fat and amino acids) compared to normal corn. The tendencies for improved ADG during phase III in Exp. 1 and improved ADG and F/G in Exp. 2 demonstrate the increasing value of HOC as a feedstuff for growing swine.

In conclusion, HOC seems to be more beneficial in late nursery diets than in the initial diets after weaning. These results may not reflect the feeding value of HOC but indicate the limited ability of the nursery pig to effectively utilize fat immediately postweaning.



Eldo Heller, Finishing Barn Manager.

Table 1. Composition of the Experimental Basal Diets (Exp. 1 and 2)

Ingredient, %	Phase II	Phase III
Corn[ab]	55.98	63.03
Soybean meal (46.5% CP)	26.51	32.37
Dried whey	10.00	-
Spray-dried blood meal	2.50	-
Soybean oil	-	-
Antibiotic[c]	1.00	1.00
Monocalcium phosphate	1.85	1.49
Limestone	1.02	1.11
Zinc oxide (72%)	.25	-
Copper sulfate	-	.08
Vitamin premix	.25	.25
Trace mineral premix	.15	.15
DL-methionine	.10	.03
L-lysine HCl	.15	.15
Salt	.25	.35
Total	100.00	100.00

[a](Exp. 1) In the second treatment, HOC replaced the normal dent corn and a portion of the soybean meal to provide the same level of lysine as the basal diet. Treatment 3 was isocaloric to the HOC treatment and contained soy oil (2.3% in phase II and 2.6% in phase III), which replaced a portion of the normal corn in the basal diet. The amount of soybean meal increased slightly to maintain a constant level of lysine across all treatments. The fourth and fifth treatments consisted of choice white grease and poultry fat, respectively, in place of the soy oil found in the third treatment.

[b](Exp. 2) The second and third treatments were identical to those in Exp. 1. The fourth treatment consisted of the second treatment (high oil corn) with the same level of soy oil as treatment three (2.3% in phase II and 2.6% in phase III). The fifth treatment was made isocaloric to the fourth treatment by including soy oil (4.4% in phase II and 5.0% in phase III) in the basal diet.

[c]Provided 50 g/ton of carbadox.

Table 2. An Evaluation of Various Fat Sources in Nursery Pig Diets and Their Effects on Growth Performance (Exp. 1)[a]

		Added Fat Source[b]				
Item	Control	HOC	Soy Oil	CWG	Poultry Fat	CV
d 3 to 13						
ADG, lb	.76	.69	.73	.71	.70	11.4
ADFI, lb	1.09[c]	1.07[cd]	1.03[cd]	1.06[cd]	1.01[d]	6.5
F/G	1.43[c]	1.56[d]	1.43[c]	1.49[cd]	1.43[c]	7.8
d 13 to 34						
ADG, lb	1.18	1.23	1.14	1.19	1.18	8.1
ADFI, lb	2.08[c]	2.15[c]	2.10[c]	2.08[c]	1.98[d]	4.0
F/G	1.75[cd]	1.75[cd]	1.85[c]	1.75[cd]	1.67[d]	7.0
d 0 to 34						
ADG, lb	1.01	1.02	.98	.99	.99	7.5
ADFI, lb	1.65[c]	1.68[c]	1.64[c]	1.64[c]	1.55[d]	4.0
F/G	1.64	1.64	1.69	1.67	1.56	6.0

[a]One hundred and eighty five weanling pigs were used (initially 12.4 lb and 20 d of age), six or seven pigs/pen and six pens/treatment.
[b]Each of these sources supplied 2.4% added fat.
[c,d,e]Means on the same row with different superscripts differ by ($P<.10$).

Table 3. A Comparison of High Oil Corn and Soy Oil as Fat Sources in Nursery Pig Diets and Their Effects on Growth Performance (Exp. 2)[a]

	Regular Corn Soybean Oil, %			High Oil Corn Soybean Oil, %		
	0	2.3/2.6	4.4/5.0	0	2.3/2.6	
ME, kcal/lb Phase II	1,464	1,504	1,541	1,514	1,550	
Item Phase III	1,475	1,520	1,561	1,531	1,573	CV
d 4 to 14						
ADG, lb	.65[bd]	.73[c]	.70[cd]	.62[b]	.66[bd]	8.6
ADFI, lb	.98[bc]	1.02[b]	.99[bc]	.97[bc]	.95[c]	7.2
F/G	1.52[bc]	1.41[c]	1.41[c]	1.56[b]	1.43[bc]	8.3
d 14 to 35						
ADG, lb	1.21	1.23	1.21	1.24	1.24	3.6
ADFI, lb	2.21	2.11	2.13	2.18	2.12	4.9
F/G	1.82[b]	1.72[c]	1.75[bc]	1.75[bc]	1.69[c]	6.0
d 0 to 35						
ADG, lb	.99[b]	1.03[c]	1.00[bc]	.99[b]	1.02[bc]	2.9
ADFI, lb	1.66	1.63	1.62	1.65	1.61	4.7
F/G	1.69[b]	1.59[c]	1.61[bc]	1.67[bc]	1.59[c]	5.0

[a]One hundred and eighty weanling pigs were used (initially 13.13 lb and 20 d of age), six pigs/pen and six pens/treatment. Treatments with added soy oil contained 2.3 and 4.4% soy oil in phase II, and 2.6 and 5.0% soy oil in phase III, respectively.
[b,c,d]Means on the same row with different superscripts differ by ($P<.10$).